REMOTE MAINTENANCE SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a remote maintenance

5   system that prevents possible failure of an apparatus or

detects a failure caused, and relates particularly to a

remote maintenance system suitable for displaying the

result of remote maintenance of general measuring equipment

(hereinafter called an apparatus-to-be-maintained)

10   including clinical inspection data analyzer or clinical

inspection data processor.

Lately, with the advancement of network technology,

it becomes easier to maintain an analyzer at a remote location

through a network. Since the capacity of analyzer for

15   clinical inspection has enhanced, effect on medical

treatment resulting from a failure of analyzer has become

more serious and it becomes necessary to find out the cause

of the failure and, upon occurrence, repair the failure

as soon as possible. For this reason, it becomes important

20   to automate failure prevention by means of remote

maintenance through a network and, further more, carry out

real-time repair activities upon occurrence of a failure.

A known conventional remote maintenance system, for

example, as disclosed in Japanese Application Patent

25   Laid-Open Publication No. HEI 6-62130 (1994), has been such

that a medical apparatus and a center in charge of the
maintenance, inspection and management of the apparatus
are connected by a telephone line and, when a failure detected
in the medical apparatus is sent to the center, a repair
command is sent from the center to the medical apparatus.

The system disclosed in Japanese Application Patent
Laid-Open Publication No. HEI 6-62130 (1994), however,
involves a problem on assurance of the quality of maintenance
because explicit indication is not considered as to whether
the apparatus has finally been maintained in a usable
condition or when the apparatus becomes usable if it is
under maintenance. For the persons engaged in clinical
inspection who are in a position of managing the apparatus
directly (hereinafter, those who directly manage the
apparatus-to-be-maintained are generically called
"personnel in charge"), it is necessary to operate the
analyzer with the help of information not only on the progress
of repair but on the result of repair and schedule of repair.
In short, the repair result information and repair schedule
information of the apparatus are very important to carry
out clinical inspection in practice but the afore-mentioned
prior art lacks in this information.

The conventional system involves another problem on
assurance of the quality of maintenance because no
consideration is given to possible uneasiness of the

personnel in charge resulting from a lack of explicit
indication as to whether sure and proper maintenance has
really been carried out in the remote maintenance that is
not attended with actual actions by operators. Generally,
5   in case of remote maintenance where maintenance activities
are automated, it holds true that the personnel managing
the apparatus directly do not feel any progress of
maintenance actually and so feel uneasy about the completion
of maintenance because the personnel cannot confirm the
10   quality of maintenance visually. In the past, the personnel
in charge were able to assure themselves of the timing and
progress of maintenance on an occasion of a visit of
maintenance service persons and actual maintenance
activities by them, and accordingly can feel the completion
15   of maintenance in actuality. In the remote maintenance,
however, the personnel cannot have this actual feeling.

The object of the present invention is to provide a
remote maintenance system which informs of the personnel
in charge that maintenance has been carried out surely and
20   properly and enables the personnel in charge to definitely
judge whether the apparatus is really in a usable condition.

SUMMARY OF THE INVENTION
(1) In order to realize the above object, the present
25   invention provides a remote maintenance system in which

a maintenance center in charge of remote maintenance is
connected to an apparatus-to-be-maintained by a
communication channel and a maintenance monitor mechanism
is installed in the apparatus-to-be-maintained or on the
5   communication channel; wherein the maintenance monitor
mechanism comprises of a maintenance control section that
controls and carries out remote maintenance of the
apparatus-to-be-maintained, a maintenance history storage
unit that records maintenance history, and a display unit;
10   and the remote maintenance system acquires the date and
time of the maintenance last carried out from the maintenance
history storage unit and displays "Maintenance Not
Problematic" if the difference between the date and time
of the maintenance and the current date and time does not
15   exceed a required maintenance interval or displays
"Maintenance Problematic" if the difference exceeds the
interval.

With this configuration, it becomes possible to inform
of the personnel in charge that maintenance has been carried
20   out surely and properly and enable the personnel in charge
to definitely judge whether the apparatus is really in a
usable condition.

(2)   That in (1) above is provided, wherein, preferably,
the date and time of the last maintenance out of those that
25   were carried out with no problem found concerning

utilization of the apparatus is used instead of the date and time of the maintenance last carried out.

(3) That in (1) above is provided, wherein, preferably, the system contains different required maintenance intervals dependent upon the type of maintenance controlled by the maintenance control section, and switches the required maintenance interval corresponding to each type of maintenance and displays "Maintenance Problematic/Not Problematic".

(4) That in (1) above is provided, wherein, preferably, the system displays restrictions concerning utilization of the apparatus in case of "Maintenance Problematic".

(5) That in (1) above is provided, wherein, preferably, the system displays current status if maintenance activity is being carried out in case of "Maintenance Problematic".

(6) That in (5) above is provided, wherein, preferably, if any restriction concerning utilization of the apparatus is caused, the system displays the restriction.

(7) That in (1) above is provided, wherein, preferably, at the request of an operator, the system judges whether the difference exceeds the required maintenance interval and displays accordingly.

(8) That in (1) above is provided, wherein, preferably, the system judges whether the battery in the maintenance monitor mechanism or in the apparatus-to-be-maintained has

run down and displays the result of the judgment.

(9) That in (1) above is provided, wherein, preferably, the system judges whether the current date and time of the timer in the maintenance monitor mechanism or in the apparatus-to-be-maintained is correct and displays the result of the judgment.

(10) That in (1) above is provided, wherein, preferably, the system is equipped with a GPS (Global Positioning System) installed inside a mobile vehicle in charge of maintenance activity, and transmits and displays the current position data of the mobile vehicle from the GPS to the display unit via the communication channel.

(11) That in (1) above is provided, wherein, preferably, the system calculates the hours required until the arrival of the mobile vehicle at the location of the apparatus-to-be-maintained, and transmits and displays the required hours on the display unit.

(12) That in (1) above is provided, wherein, preferably, the system is equipped with a maintenance history storage unit installed in the maintenance center, and,

when the communication channel between the maintenance center and the apparatus-to-be-maintained is connected, compares the maintenance history recorded in the maintenance history storage unit in the maintenance center

at the last connection of the communication channel to the maintenance history recorded in the maintenance history storage unit in the maintenance monitor mechanism, and carries out remote maintenance if the two records agree

5   with each other or shuts down the communication channel if not.

(13) That in (1) above is provided, wherein, preferably, the system displays the maintenance histories in the maintenance history storage unit on the display unit.

10   (14) That in (1) above is provided, wherein, preferably, the system displays the required maintenance interval, current time of the timer, and maintenance history in the maintenance history storage unit, either in strings of numeric numbers of the frequency distribution calculated

15   per specified unit time or in a form of distribution histogram charting the strings of numeric numbers in time series, on the display unit.

BRIEF DESCRIPTION OF THE DRAWINGS

20   Fig. 1 is a block diagram showing the configuration of a remote maintenance system according to an embodiment of the present invention:

Fig. 2 is a flowchart showing the maintenance monitor processing operation by a maintenance monitor mechanism

25   of a remote maintenance system according to an embodiment

of the present invention:

Fig. 3 is an explanatory sketch showing an example of display on a display unit in a remote maintenance system according to an embodiment of the present invention:

5   Fig. 4 is an explanatory sketch showing an example of display on a display unit in a remote maintenance system according to an embodiment of the present invention:

Fig. 5 is a flowchart showing the maintenance processing operation by a maintenance center of a remote maintenance

10   system according to an embodiment of the present invention: and

Fig. 6 is a block diagram showing the configuration of a remote maintenance system according to another embodiment of the present invention

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DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

The configuration and operation of a remote maintenance system according to an embodiment of the present invention are explained hereunder, using Fig. 1 to Fig. 5.

20   First, the configuration of a remote maintenance system according to an embodiment of the present invention is explained, using Fig. 1.

Fig. 1 is a block diagram showing the configuration of the remote maintenance system according to an embodiment

25   of the present invention.

A maintenance monitor mechanism 300 that carries out and monitors remote maintenance and a maintenance management section 201 that manages individual apparatus-to-be-maintained in a maintenance center 200 at a remote location are connected by a communication channel 100.

The maintenance monitor mechanism 300 is equipped with a maintenance control section 310, maintenance history storage unit 320, timer 330, comparator 340, and display unit 350. The maintenance control section 310 carries out maintenance of an apparatus-to-be-maintained 400. The maintenance control section 310 carries out maintenance of the apparatus-to-be-maintained 400 in reply to a maintenance command from the maintenance management section 201 or on its own initiative.

Here, the apparatus-to-be-maintained 400 includes, for example, analyzer and data processor used in clinical inspection. Analyzer means, for example, a biochemical analyzer in which specimen and reagent are mixed together and the absorbance of the mixture is measured by a multi-wavelength photometer set at a suitable wavelength for each analysis item. An analyzer like the above comprises of a mechanism for placing a specimen separately into a reaction container, mechanism for pouring reagent into the reaction container, mechanism for stirring the mixture in

the reaction container, multi-wavelength photometer for measuring the absorbance of the mixture in the reaction container, mechanism for washing the reaction container after use, operating section for entering analysis items required for each specimen and instructing start or end of the analysis, and the like. Data processor connected to an analyzer by a communication line, for example, sends the request information to the analyzer as to which specimen is to be analyzed on what analysis item and receives the result information as to what result is obtained from which specimen, enabling to enter, store, update and report the above information.

When maintenance has been carried out, the maintenance control section 310 of the maintenance monitor mechanism 300 records the history in the maintenance history storage unit 320. Record contains the date and time of the maintenance and whether any problem is found in the apparatus-to-be-maintained through the maintenance.

The comparator 340 acquires the current date and time from the timer 330 that clicks and indicates date and time on real time. The date and time information contains current year, month, day, hour, minute, and second. Further, the comparator 340 acquires the date and time of the maintenance last carried out (hereinafter called the last maintenance date and time) from the maintenance history storage unit.

The comparator 340 calculates the difference between the acquired current date and time and last maintenance date and time, and displays "Maintenance Not Problematic" on the display unit 350 if the difference does not exceed a

5   required periodic maintenance interval or displays "Maintenance Problematic" on the display unit 350 if the difference exceeds the interval. An interval of maintenance to be carried out next is specified in periodic maintenance and, if none is carried out within this interval,

10   it means delay of maintenance. In order to inform that the quality of periodic maintenance has been lost, "Maintenance Problematic" is displayed on the display unit 350.

    The maintenance monitor processing operation by the maintenance monitor mechanism 300 of the remote maintenance

15   system according to the embodiment is explained hereunder, using Fig. 2 to Fig. 4.

    Fig. 2 is a flowchart showing the maintenance monitor processing operation by the maintenance monitor mechanism 300 of a remote maintenance system according to an embodiment

20   of the present invention. Figs. 3 and 4 are explanatory sketch showing an example of display on the display unit in a remote maintenance system according to an embodiment of the present invention.

    First, in step S100, the maintenance control section

25   300 of the maintenance monitor mechanism 310 waits for one

minute. That is, the maintenance monitor processing of the embodiment operates in one-minute cycle. This cycle is not necessarily be limited to one minute but can be shorter or longer than one minute provided that the freshness of

5   the maintenance quality displayed meets the requirement. An object of a wait in step S100 can be anything that generally provides updating timing. For example, waiting until a specified time or waiting for an explicit command from the operator is acceptable.

10   Next, in step S110, after the wait time in step S100 has elapsed, the maintenance control section 310 acquires the present date and time and stores it in register A.

Next, in step S120, the maintenance control section 310 judges whether the maintenance history storage unit

15   320 is empty or not. When the maintenance monitor mechanism 300 is first operated after installation in a system, the maintenance history storage unit 320 is empty because no maintenance has ever been carried out. Besides, it is anticipated that the maintenance history storage unit is

20   made empty by some chance by illegal hacking. If the maintenance history storage unit 320 is empty as above, the processing proceeds to step S170 and non-existence of maintenance history is displayed on the display unit 350. If not empty, the processing proceeds to step S130.

25   If the processing in step S130, which is to be explained

later, is changed so as to acquire the date and time of the last maintenance out of those that were carried out with no problem found in the apparatus-to-be-maintained, there may be a case where no applicable maintenance history

5   is stored. Existence of such history is checked in step S120 and, if none, non-existence is displayed in step S170.

If the maintenance history storage unit 320 is not empty, in step 130, the maintenance control section 310 acquires the date and time of the maintenance last carried out from

10   the maintenance history storage unit 230 and stores it in register B. It is possible to change this step S130 so as to acquire the date and time of the last maintenance out of those that were carried out with no problem found in the apparatus-to-be-maintained. With this change, more

15   practical quality of maintenance can be displayed.

Next, in step S140, the maintenance control section 310 compares the time difference (A-B) between the present date and time, stored in register A, and the date and time of the maintenance last carried out, stored in register

20   B, to a periodic maintenance interval. Here, (A-B) represents the time that has elapsed with no maintenance carried out. The processing proceeds to step S160 if the time exceeds the periodic maintenance interval, or to step S150 if not.

25   If the time (A-B) that has elapsed with no maintenance

carried out exceeds the periodic maintenance interval, it means that periodic maintenance has not been carried out punctually. Accordingly, in step S160, the maintenance control section 310 displays "Maintenance Problematic" on

5   the display unit 350.

If the time does not exceeds the interval, it means that periodic maintenance has been carried out punctually and that the apparatus-to-be-maintained is not problematic. Accordingly, in step S150, the maintenance control section

10   310 displays "Maintained and Inspected" on the display unit 350.

An example of display concerning "Maintenance Not Problematic" is explained hereunder, using Fig. 3.

In order to show that no failure is found in maintenance

15   and inspection, "Maintained and Inspected" is displayed on a maintenance condition display area 352. In order to show the status of periodic maintenance in detail, the present date and time is displayed on a display area 354 and the date of the maintenance last carrier out or date

20   of the last maintenance out of those that were carried out with no problem found in the apparatus-to-be-maintained is displayed on a display area 356.

The purpose of displaying the present date and time on the display area 354 is not only to visually confirm

25   the difference from the last maintenance and inspection

date but to visually check normal operation of the timer
330 and to monitor the date and time which may have been
altered by some chance by illegal hacking. In particular,
considering a risk of data crack by illegal hacking as in
5   the latter case, it will be preferable to show the contents
of the maintenance history storage unit or pre-determined
periodic maintenance interval.

The timer 330 may operate incorrectly and display other
past date and time than the present, resulting from running
10   down or the like of a battery driving the timer. Since the
time difference (A-B) in step S140 is shown as a negative
value on this occasion, displaying an alarm in case (A-B)
is negative enables to report the above failure of the timer
330 indirectly.

15   Another means for detecting incorrect operation of the
timer 330 would be such that the maintenance center 200
accesses the maintenance monitor mechanism 300 by
communication 100, reads the indication of the timer 330,
and judges whether the difference between the indication
20   and the present time controlled by the maintenance center
is within an allowable limit. Displaying this error on the
display unit 350 or reporting it to the operator in the
maintenance center if not allowable enables to prevent an
error of the timer 300. Besides, since the timer 330 is
25   normally driven by a battery inside, incorrect operation

of the timer 330 can be prevented by checking whether the
battery driving the timer has run down instead of checking
the present time acquired from the timer.

The timer 330 is located inside the maintenance monitor

5   mechanism 300 in an example shown in Fig. 1 but not limited
thereto, and, for example, it is acceptable to commonly
use a timer incorporated in the apparatus-to-be-maintained.
The contents of the maintenance history storage unit 320
are displayed by descriptions in character strings but some

10   other ways are also acceptable; displaying a total number
of times of maintenance or displaying a number of times
of maintenance by a chart in time series.

Next, an example of display concerning "Maintenance
Problematic" is explained hereunder, using Fig. 4. In order

15   to show that a problem is found in maintenance, "Maintenance
and Inspection Required" is displayed on the display area
352 of the display unit 350. The present status of the
required action and the expected date of repair are also
displayed on a display area 358. This example shows that

20   the parts necessary for repair are on the way of
transportation and the repair is scheduled for completion
at 11:00 on January 1, 2000.

Pieces of information displayed as above can be more
accurate by using, through the communication channel 100,

25   the latest information on the maintenance activities

accumulated in the maintenance center 200. Besides, it will be preferable to display a scheduled visit of a maintenance service person so as to inform of expected completion of repair. It will also be preferable by way of preventive

5   maintenance to display a notice about a part that is judged advisably necessary to be replaced soon.

The date and time is displayed in a clock format (year, month, day, hour, minute, and second) in the examples above, but remaining hours until the target date and time can be

10   utilized instead. For example, it will be preferable to display the remaining hours until when a maintenance service person visits or remaining hours until when the next maintenance is carried out.

Whether maintenance is problematic or not is expressed

15   in character strings in the examples above, but other ways of display will also be acceptable. In addition, it will be preferable to utilize explicit perceptible means such as color, graphics, animation, alarm sound and light as a means for describing a problem in maintenance and

20   inspection. With these means, more effective report of the problem can be issued. As a more direct means, notice by a pager, e-mail or voice message will be preferable.

In order to improve the quality of periodic maintenance displayed, it is preferred in acquiring the last maintenance

25   date not to simply find out the maintenance last carried

out but to find out the last periodic maintenance out of those that were carried out with no problem found in the apparatus-to-be-maintained, thus enabling to report a status even with unsolved problem to the personnel in charge.

5   Although it is periodic maintenance that is displayed of its maintenance quality in the example above, the quality of occasional maintenance can also be displayed as more general maintenance provided that the history is stored in the maintenance history storage unit and the periodic

10   maintenance interval applied in the comparator 340 is replaced with an interval allowable to the personnel in charge. With the help of the displayed information as above, the personnel in charge can easily understand the quality of remote maintenance of the apparatus.

15   In general remote maintenance, a piece of operating information of an apparatus-to-be-maintained is referred to and a system makes a judgment of carrying out an actual maintenance action if a calculated value concerning the information exceeds an allowable limit. Operating

20   information means record of the condition of an apparatus-to-be-maintained while the power to the apparatus is on. The operating information includes periodic maintenance information necessary for carrying out periodic inspection of the apparatus, failure information on

25   failures detected and recorded by the apparatus

automatically, and analytical environment tracing
information collected by an analyzer in carrying out an
analysis. The periodic maintenance information includes
operating hours of the apparatus, number of times of

5   operation of a special mechanism such as a syringe mechanism
for placing a specimen separately, and history of the
maintenance carried out manually by the personnel in charge.
The failure information includes record of alarm codes
corresponding to a failure detected by the apparatus and

10   record of parameters upon occurrence of the failure. The
analytical environment tracing information includes
operating record of the mechanism, alarm on the measured
data, and parameters needed for the calculation of the
measured data. The operating information as above is

15   interpreted in the maintenance control section 310 or
maintenance management section 210 to a certain judgment
criterion and linked to the maintenance activities, such
as replacement of parts of the apparatus, as needed. It
is not always limited to a judgment of the operation

20   information that is covered by the remote maintenance
according to this embodiment, but general maintenance
activities of the apparatus-to-be-maintained that can be
operated from a remote point are covered.

It is only one set of maintenance monitor mechanism

25   300 that is connected to the maintenance center 200 in an

example shown in Fig. 1, but not always limited thereto.
Generally, multiple analyzers or data processors in
multiple hospitals or analysis centers are connected to
the maintenance center 200. Besides, multiple maintenance

5   centers can be installed for different types of maintenance.
In addition, the maintenance monitor mechanism and the
apparatus-to-be-maintained are separate in Fig. 1 but it
is not always necessary. For example, whole or part of the
maintenance monitor mechanism can be incorporated in the

10   apparatus-to-be-maintained. In this case, for example,
the display unit 350 can be realized by common use of a
display unit originally installed on the
apparatus-to-be-maintained. It is also acceptable that
the maintenance monitor mechanism is included in the

15   maintenance center, where the maintenance monitor mechanism
is connected to one or more apparatuses M. In other way,
the maintenance monitor mechanism may be connected to
multiple apparatuses M and displays the quality of
maintenance of the multiple apparatuses. In this case, each

20   apparatus can be equipped with a maintenance history storage
unit 320 and a comparator 340 so as to monitor each apparatus
differently. In a similar way as above, occasional
maintenance can be monitored of its performance as is the
periodic maintenance if a maintenance history storage unit

25   is installed separately and occasional maintenance

information is inputted through the maintenance center or from a data entry device of the maintenance monitor mechanism.

Further, there may happen a case where the periodic
5   maintenance interval is different among multiple maintenance services to be carried out for the same apparatus-to-be-maintained. Even in this case, it becomes possible to carry out and monitor multiple maintenance services of various types if a periodic maintenance interval
10   applied in the comparator 340 is kept for each type of maintenance service and the applicable periodic maintenance interval is added to the history information in the maintenance history storage unit. Even in a case where a single maintenance service is to be carried out but the
15   applicable periodic maintenance interval needs to be modified, it becomes possible if a data entry device for the modification is provided on the maintenance monitor mechanism or the periodic maintenance interval is modified from the maintenance center by remote communication.

20   Next, the maintenance processing operation by the maintenance center 200 of the remote maintenance system according to the embodiment is explained hereunder, using Fig. 5.

Fig. 5 is a flowchart showing the maintenance processing
25   operation by the maintenance center of a remote maintenance

system according to an embodiment of the present invention.

First, in step S200, the maintenance management section 201 of the maintenance center 201 waits for a primary factor for carrying out remote maintenance. Remote maintenance

5 is carried out due to a primary factor that the maintenance service personnel of the maintenance center needs to carry out maintenance for emergency, maintenance (including periodic maintenance) is to be carried out automatically at a timing pre-determined by the maintenance center, or

10 a request for maintenance (including periodic maintenance if periodic maintenance control is included in the maintenance monitor mechanism) is issued from the maintenance monitor mechanism installed at the apparatus-to-be-maintained.

15 When one of the above is caused, the maintenance management section 201 connects the line in step S210.

Next, in step S220, the maintenance management section 201 identifies a user station on the other end of the line by the connection address of the line or the apparatus ID

20 (a unique identifier for identifying each apparatus) held in the maintenance monitor mechanism or apparatus-to-be-maintained. Particularly when the line is connected at the request of the maintenance center, whether the identified user station is identical with the expected

25 user station is checked. If it is identical, the processing

proceeds to step S230 and, if not, to step S260.

Even when the line is connected at the request of others than the maintenance center, a similar processing is operated so as to ensure that the user station on the line is registered in the maintenance center as an apparatus-to-be-maintained.

After the user station is identified as above, the maintenance management section 201 then identifies the user station by the maintenance history in step S230. If a remote maintenance service had been carried out at the time of previous line connection, maintenance history in the maintenance history storage unit must have been acquired already. So, the maintenance history acquired at that time is compared to the maintenance history of the user station in question. If they are identical, the processing proceeds to step S240 and, if not, to step S260.

If the two histories are identical, the user station can be identified as the expected user station. So, in step S240, the maintenance management section 201 carries out a remote maintenance service.

Then, in step S240, the maintenance management section 201 acquires the maintenance history.

After the above, in step S270, the maintenance management section 201 disconnects the line.

If a judgment either in step S220 or in step S230 results

in no identity, it is likely that the maintenance history

storage unit has been illegally modified or the connection

is made with a wrong user station. In step S260, therefore,

the maintenance management section 201 reports

5   impossibility of identification to the maintenance service

personnel so as to initiate investigation and remedial

action by maintenance service persons

Detection of no identity as above can be fed back to

the apparatus-to-be-maintained so as to display

10   "Maintenance Problematic" on the display unit 350.

Then, in step S270, the maintenance management section

201 disconnects the line.

Comparison of the maintenance history can be that of

the last maintenance history, several latest ones, whole,

15   or part. In case a maintenance center is engaged only in

specific maintenance, only those specific maintenance

histories can be picked up for comparison.

According to the embodiment, as explained above, by

acquiring the date and time of the maintenance last carried

20   out from the maintenance history storage unit and displaying

"Undergone Periodic Maintenance" if the difference between

the above and the current date and time does not exceed

a periodic maintenance interval or displaying "Periodic

Maintenance Required" if the difference exceeds the

25   interval, it becomes possible to inform the personnel in

charge clearly that the quality of the

apparatus-to-be-maintained has been kept assured by the

maintenance. In other words, since the result of periodic

maintenance is checked into the history and then the quality

5   is displayed, the personnel in charge can easily confirm

that the quality has been kept assured. This method applies

not only to periodic maintenance but to occasional

maintenance, wherein the quality can also be displayed as

above and accordingly the personnel in charge can easily

10   confirm the quality if necessity and completion of

maintenance are reflected on the maintenance history as

needed.

The same effect as above can be expected by acquiring

the date and time of the last maintenance out of those that

15   were carried out with no problem of the apparatus found

from the maintenance history storage unit and checking the

difference between the above and the present date and time

in the same manner as explained above.

Where specific maintenance is under way in the

20   maintenance control section, if present status of the

maintenance, restriction on utilization of apparatus, and

expected completion date and time of the maintenance are

displayed on the display unit, the personnel in charge can

easily predict a timing of release from the restriction

25   on utilization of the apparatus due to the maintenance.

Further, where an actual maintenance action (e.g.
replacement of parts) is needed, if detailed restriction
on utilization of apparatus resulting from the maintenance
and expected timing of release from the restriction are

5   displayed, the personnel in charge can form an alternative
plan more easily and loss due to the restriction can be
made minimal.

If the content of the maintenance history storage unit
is kept in the maintenance center each time when a maintenance

10   command is issued from the maintenance center and a
maintenance history is recorded in the maintenance history
storage unit, and if it is ensured at the next time when
the apparatus is connected to the maintenance monitor
mechanism for maintenance that the content of the

15   maintenance history storage unit has not been changed, it
becomes possible to ensure that the maintenance monitor
mechanism has not been utilized illegally for other purposes
and that the user station connected from the maintenance
center via the communication channel is correct.

20   Beside, if multiple apparatuses M are connected and/or
multiple maintenance centers for different purposes of
maintenance are installed, coverage and efficiency of
maintenance can be enhanced. There may be a case where
maintenance requires multiple inspections with different

25   periodic maintenance interval but this diversification in

maintenance can also be managed if multiple periodic

maintenance intervals are prepared and assured

implementation of maintenance in those intervals is

monitored. Display of the quality of maintenance must not

5   always be periodic but, for example, the quality may be

displayed from time to time by the request of the personnel

in charge by pressing a key or switch. Thus, the personnel

in charge can recognize the quality of maintenance on a

timely basis.

10   In identifying an apparatus to be maintained by remote

maintenance, comparing the maintenance history in the

maintenance history storage unit with that in the

maintenance center enables not only to ensure

identification of the apparatus-to-be-maintained and

15   prevent deterioration of the quality of the apparatus

resulting from possible maintenance on wrong

apparatus-to-be-maintained but also to ensure that the

maintenance function has not been utilized illegally

through the network and, if it has been, cooperate in taking

20   necessary actions so as to prevent illegal utilization.

Further more, displaying the contents of the

maintenance history storage unit, periodic maintenance

interval, current time of the timer, and histogram of number

of times of maintenance enables to check and ensure that

25   maintenance has been carried out surely and no illegal

utilization has been made. Besides, check of running down of a battery driving the timer and check of the present time of the timer enable to monitor maintenance more strictly. Displaying the content of the maintenance history storage

5   unit allows the personnel in charge to recognize the progress of maintenance.

Next, the configuration and operation of a remote maintenance system according to another embodiment of the present invention is explained hereunder, using Fig. 6.

10   Fig. 6 is a block diagram showing the configuration of the remote maintenance system according to another embodiment of the present invention. The same symbol as in Fig. 1 represents the same portion.

A maintenance monitor mechanism 300 is connected, via

15   a communication channel 450, to multiple apparatuses M: analyzers 401 and 402, and data processor 403. The maintenance monitor mechanism 300 monitors maintenance of these three apparatuses.

A maintenance center 200 is connected, via a

20   communication channel 101, to a GPS (Global Positioning System) 501 inside a maintenance service car 500. It is possible to determine, with the aid of the GPS 501, where the maintenance service car is located at present and send and display the geographical information or expected

25   arrival time at an apparatus-to-be-maintained on the

maintenance monitor mechanism via the maintenance center 200. With this function, even in case an apparatus has failed and a maintenance service such as replacement of parts is needed, the user of the apparatus can precisely

5   predict the time of recovery from the failure and, by forming a plan based on the prediction, deterioration of medical services resulting from the failure can be made minimal.

According to the embodiment, in addition to the effect of the embodiment as explained above, accuracy in predicting

10   the expected completion of maintenance can be further improved by calculating the expected arrival time from the geographical position of a maintenance person or maintenance parts on the GPS.

Displaying the two-dimensional geographical

15   information and current position information from the GPS on the display unit as they are allows the personnel in charge to feel safer.

According to the present invention, it is possible to inform the personnel in charge as to whether maintenance

20   has been carried out surely and correctly and enable to definitely judge whether the apparatus is really in a usable condition.